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and he does not know how it compares with others. But it is one of the most recent and considered one of the best. The technical advances in psychology are borne witness to by the fact that the psychologist would not like to use a recording apparatus whose error is over 1σ , whereas the variable error of this instrument is about 20σ , and the constant error is not entirely eliminated by the ingenious method of reversing the motion of the carriage.

The paper last on this list is the most important for astronomy, but does not especially concern psychology. As long ago as 1849, Faye suggested the possibility of recording transits by photography, and this has now been actually accomplished. It is not necessary to describe here the methods and apparatus used in the Georgetown College Observatory under the general direction of the Rev. Father Hagen. Stars of the fourth magnitude have been successfully photographed in transit, what Prof. Young calls the "annoying human element" being largely eliminated. The photographic method will probably be applied with great advantage to many physical measurements.

The interests of psychology are not especially served by any of these papers. Astronomers naturally wish to do away with the personal equation rather than to study it. The most important advances have been in this direction. The Repsold method transfers the error to a certain extent from the observer to the instrument, and the photographic method does away with the observer altogether during the actual transit. The work of astronomers becomes less important for psychology as their devices become more mechanical, and as psychology itself learns to state and to solve its own problems. On the other hand recent advances in psychology are of increasing importance to astronomy and the other physical sciences. Physical measurements in the last resort must always depend on the accuracy of the eye and hand. Errors of observation are now studied in psychology with an exactness which has never been approached in any physical science. There are but few physicists and mathematicians who understand the position of psychology in this matter. The physicist cannot know the true value of the quantity he is seeking to determine; he deals with residuals not with errors. The psychologist on the other hand determines actual errors, and can study their nature, size and dispersion in a manner entirely beyond the reach of physics. The whole theory of the method of least squares is concerned with variable errors, and is helpless in the presence of constant or systematic errors. Constant errors are, however, far more important and dangerous than variable errors, and these can be measured and eliminated by the psychologist. Astronomers have, indeed, attempted this with their artificial transit instruments, but they have been playing the part of the psychologist, in most cases without adequate methods or knowledge.

ARDIGÒ, *Alcune osservazioni relative alla legge psicologica del riconoscimento*, Rivista di filosofia scientifica 1891 X 577.

The author relates an experience in the reproduction of a dream which seems to support his theory of re-cognition. He presents several considerations on cognate points from which he deduces two consequences, the one in regard to the association of ideas and the other relation to the theory of reasoning. The former denies that the process of association is the revival of terms one after the other that exist separately in the organic predisposition of the cerebrum, but asserts that it is a re-enlivenment little by little in various parts of an ample system which acting in its integrity from one point to the other does so in successive moments and with variations of intensity in different parts. Thus it is

deduced that the principle of association is the same for simultaneous and successive associations and for those of similarity; moreover we see that there are two species of simultaneous and successive associations, the direct and the indirect. The direct association of coexistence and sequence takes place because the single system preformed as a physiological synergy is aroused in its integrity, reacting successively in its parts. The association by similarity takes place because the special rhythm of such an entire system stimulates analogous rhythms of other systems physiologically preformed, in the same way that a piano-string in vibration produces resonating vibrations in other strings of analogous rhythm. The indirect association of coexistence and sequence takes place because the rhythm of activity, when there is consciousness of one term of an associative series, arouses the analogous rhythm of a term of another associative series in such a way that the whole physiological system takes part in it. Reasoning is nothing more than a product of the law of recognition.

E. W. SCRIPTURE.

SCRIPTURE, *Ueber den associativen Verlauf der Vorstellungen*, Inaug. Diss. Leipzig 1891; also Phil. Stud. 1891-2 VII 50.

The first step to a scientific treatment of the subject must be a careful collection of material instead of the fictitious examples generally in use. The course of ideas in consciousness can for the sake of scientific study be divided into four processes: preparation, influence, addition and posterior effect. The process of preparation is the change which an apperceived idea undergoes before it influences the course of consciousness. In one form of association the whole of the apperceived idea acts and remains in the result; e. g. the word *Kothe* calls up the phrase "in *Kothe*," (p. 17). In another form the whole of it evidently acts but the resulting idea does not contain it: e. g. touch-impression from a piece of paper—word "paper," (p. 17). Often only part of the apperceived idea is of effect, that is, it is diminished by the concentration of the attention on certain parts which are active in producing the result whereas the other parts are apparently lost; this is the process of the diminution of an idea. Example, *Rahm*—*Raum*; the association is caused by the three letters while the other disappears (p. 20). The second fundamental process is the influence of ideas on the course of consciousness. It is of two kinds, direct and indirect; the former is the case where an idea produces a change without the intervention of another idea; example, "ach!"—"ach, weh!" taste of lemon juice—word, "lemon juice;" sound of a tuning-fork—visual image of a tuning-fork (p. 26). The other form is the indirect influence. Sir Wm. Hamilton thinking of Ben Lomond associated to it the apparently unconnected Prussian system of education; he had, however, once met a German on that mountain and the association can be explained by supposing the unconscious links of association thus: Ben Lomond—the German—Germany—Prussia—the Prussian system. To test the point by experiment, a series of cards was prepared on half of which were German words, *A, B, C, D*, and some unknown Japanese letters, *u, v, w, x*; the other half contained Japanese words in Roman characters, *M, N, O, P*, with the same Japanese letters, *w, u, x, v*. The series having been shown in this way, one of the German words was then exposed without the Japanese letter and the observer was to notice on what he next thought. The Japanese letters were generally forgotten and the Japanese word in Roman characters was often associated without the observer knowing why. The probability of the correct Japanese word being associated to the German word was about one to five; actually this occurred in the ratio of nearly three to two, or, if some cases where other influences were at work be omitted, in the ratio of two to one. Experiments with other combinations of ideas, e. g.